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Moving People or Jobs?
A New Perspective on Immigration and International Outsourcing

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Abstract

We present a model that allows us to compare the effects that frictions involved in immigration and international outsourcing have on the skilled-unskilled wage inequality. We show that, for any given level of contractual friction in the production of intermediate goods, the wedge between the wages of the skilled and unskilled workers widens as the frictions in immigration wear out. The skilled-unskilled wage gap, for any given level of friction in immigration, is sensitive to variations in contractual frictions in intermediates that affect international outsourcing.

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"*Although immigration and international outsourcing do differ in the manner in which local wage rates (or employment levels) are affected, the current scare scenarios need to be placed in context*." R. W. Jones (2005)

1. Introduction

The forces of immigration to and outsourcing from the U.S. continue to draw increasing attention of those in the media and academics. On the one hand, U.S. legal and illegal immigration combined averages over 1.5 million a year. Most immigrants to the United States are unskilled and originate in developing countries. According to the Bureau of Labor Statistics, between 2002 and 2012, the U.S. economy is expected to create 56 million new jobs, half of which will require no more than a high school education. More than 75 million baby boomers will retire in that period and declining native-born fertility rates will be approaching replacement level. Native-born workers, meanwhile, are becoming more educated with every decade. While in the 1960s, half of all Americans dropped out of high school to look for unskilled work, less than 10% do so now.[1] On the other hand, no economist would dispute Gregory Mankiw's[2] observation that outsourcing has become America's "new way of doing international trade" which makes it "a good thing" but a group of politicians, journalists[3] and consulting agencies continue to warn against "export of jobs" to countries like India, Brazil and China. While academic interest in international migration dates back to the early 20th century, the literature on outsourcing has far outpaced that on immigration.[4] With this backdrop, in this article, we offer a new perspective on the labor market effects of immigration by embedding it in a model of outsourcing subject to contractual incompleteness.

The rest of the paper is organized as follows. In the next section, we provide a brief review of the relevant literature. In section 3, we present our model and propositions. We draw our conclusion section 4.

2. Literature

Academic interest in identifying the forces behind international migration dates back to Jerome (1926). However, in the early 1990s the absence of a coherent theory of immigration began to trouble several researchers[5] as conflicts between key empirical regularities and the predictions of existing theories of immigration were becoming increasingly conspicuous. Stark (1994) remarked that one of the least satisfactory features of theories of immigration, available at that time, was their lack of ability to predict a corpus of stylized facts rather than provide an ad hoc analytical rationale for an isolated observation. Massey and Zenteto (1999) argued that immigration is "path dependent" since choices made by a few early immigrants determine the direction of the floodtide that follows as networks tend to create a momentum for immigration. Chiswick (2000) offered a variant of the human capital investment model of migration where an individual computes the gross benefit to migration, based on the wage difference in the source and the destination, and compares it with the cost of migration, which could include both foregone earnings and direct costs. Hendricks (2001) developed a model of immigration with positive assortative matching under incomplete information in which worker skills are complementary in production and only imperfectly observable by firms.

The phenomenon of outsourcing is certainly not new. Yet it has appeared more frequently in the recent literature on international trade. Several authors, including Jones and Engerman (1996), Jones and Kierzkowski (1998, 2001, 2003), Arndt (1998),

Deardorff (1998), Harris (1998), Grossman and Helpman (1999), Jones (2000), Jones and Marjit (2001), Marjit *et al* (2003), Kohler (2004), Wan (2005), Long (2005), and Jones, Kierzkowski, and Lurong (2005) have captured distinct dimensions of outsourcing through parsimonious yet meaningful modifications of the traditional structure of general equilibrium models of international trade.

The traditional theories of trade and their refinements have had much to offer in terms of explaining the phenomenon and consequences of outsourcing (Jones (2000)). Still continued attempts at understanding the complex organizational arrangements encompassed by the process of transnational production sharing, have given birth to a growing body of literature beyond traditional trade theories that treated the choice of a firm's organizational form as exogenous by focusing on the production and sale of final goods and/or on arms-length transactions while incorporating trade in intermediate goods. Some notable contributions include Grossman and Helpman (2002, 2003, 2005), Antràs (2003, 2005), Antràs and Helpman (2004), Grossman, Helpman and Szeidl (2005) and Acemoglu *et al* (2007).

We hope to complement these contributions by embedding immigration in a model of outsourcing subject to contractual incompleteness.

3. Model and Propositions

Consider[6] a world that has three countries (indexed by j = 0, 1, 2) and ends in two periods (indexed by t = 0, 1). In the initial period, each country is endowed with only unskilled labor (L_u^{j0}) that produces only one non-traded homogeneous agricultural good (X) using constant-returns-to-scale technology. Each unskilled worker is rewarded w_u^{jt}. We assume that unskilled workers live for two periods and $w_u^{00} > w_u^{10} = w_u^{20}$. In the final

period, the amount of unskilled labor remains unchanged (i.e. $L_u^{j1} = L_u^{j0}$) but country 0 (the home country where the research center is located) is endowed with an additional pool of skilled workers (L_s^{01}) who live for one period. Each skilled worker in country 0 is rewarded w_s^{01}.

Country 1 is the origin of exogenous immigration flows of unskilled labor to country 0 and country 2 is the destination for outsourcing from country 0. Let μ represent the premium, due to friction in immigration, necessary to induce a worker to move from country 1 to country 0 i.e. the wage of an unskilled worker in the home country 0 is $w_u^{01} = (1+\mu)w_u^{11}$.

In the final period, a single firm produces a brand of a differentiated product (*Y*), for which it faces an iso-elastic demand function[7]:

$$y = \lambda\, p^{\frac{1}{\alpha-1}} \qquad \alpha \in (0,1) \tag{1}$$

where *p* is the price of the good. Production of good *Y* is characterized by:

$$y = \xi_z x_h^{1-z} x_l^z \qquad z \in (0,1) \tag{2}$$

The revenue generated is:

$$R = \lambda^{1-\alpha} \xi_z^{\alpha} x_h^{\alpha(1-z)} x_l^{\alpha z} \quad . \qquad \alpha \in (0,1)\,,\ z \in (0,1) \tag{3}$$

Here $\xi_z = z^{-z}(1-z)^{-(1-z)}$, x_h is a high-tech intermediate good (e.g. research and development, marketing etc.) and x_l is a low-tech intermediate good (e.g. manufacturing, assembly etc.). The skilled-unskilled wage-ratio (ω), in general equilibrium, for the home country is:

$$\omega = \frac{w_u^{01}}{w_s^{01}} = \left(\frac{2}{\alpha \int_{\bar{z}}^{1} z f(z) dz} - 1 \right) \frac{L_u^{01}}{L_s^{01}} \tag{4}$$

where $f(z)$ is the probability density function associated with the fraction of manufacturing plants employing native unskilled workers.

FIGURE1 ABOUT HERE

Each intermediate, x_i $(i = h, l)$, can be of high or low quality. If either of the two intermediates is of low quality, the output of the final good is zero. If both intermediates are of high quality, production of the final good requires no additional inputs. In country 0, production of one unit of a good-quality high-tech intermediate requires the employment of one unit of skilled labor. Since country 0 alone is endowed with skilled workers x_h is produced exclusively in country 0. Production of the high-quality low-tech intermediate requires unskilled labor and the unit input requirement is assumed to be equal to 1.

The sequence of events is as follows. At t =1, a research center located in the home country, decides whether to produce the high-tech intermediate and, if so, whether to obtain the low-tech intermediate from an independent manufacturing plant in country 0 that hires unskilled immigrant workers from country 1 or from a manufacturing plant in country 2 to maximize its *ex ante* profits. Upon entry, the manufacturer makes a lump-sum transfer T to the research center. Because of the existence of a large number of identical potential manufacturers of the final good, competition among them will make T adjust so as to exhaust the manufacturer's profits. The source of contractual incompleteness arises from international production sharing[8]: the manager of the research center in country 0 and that of a manufacturing plant can not sign an enforceable contract

specifying the purchase of a certain type of intermediate input for a certain price. Otherwise, the party receiving a positive payment would have an incentive to produce the low-quality intermediate at a negligible cost. The parties can not write contracts contingent on the volume of sale revenues obtained when the final good is sold. The only contractible ex ante is the transfer between the parties.

For simplicity in the exposition of the proofs of our propositions, let

$$A(z)=\frac{1}{1+\mu}\left(\frac{2(1-\alpha)^{\frac{1-\alpha}{\alpha}}}{\left(1-\frac{1}{2}\alpha\right)^{\frac{1-\alpha}{\alpha}}}\right)^{\frac{1}{z}}.$$

Proposition 1. *As the friction in immigration falls (rises), the skilled-unskilled wage gap rises (falls) in the home country.*

Proof: Consider first the decision of the research center in country 0 to transact with an independent manufacturer located in country 0 that hires unskilled workers migrating from country 1 to country 0. This leaves no room for *ex post* renegotiation between the research center and the manufacturer since the two parties can write an *ex ante* quality-contingent contract. Using backward induction, the research center's problem is to

$$\underset{\{x_h,x_l\}}{\text{Maximize: }}\Pi^0=R-w_s^{01}x_h-(1+\mu)w_u^{11}x_l$$

The ex ante profits, with immigration (*IMM*), for the research center boils down to

$$(5)\qquad \Pi_R\big|_{IMM}=\lambda(1-\alpha)\left(\frac{\left((1+\mu)w_u^{11}\right)^x\left(w_s^{01}\right)^{1-x}}{\alpha}\right)^{\frac{\alpha}{\alpha-1}}$$

Consider next the decision of the research center in country 0 to transact with an independent manufacturer that is located in country 2 and employs unskilled workers located in country 2. In this case, the initial contract between the research center and the manufacturer stipulates only the transfer (*T*). The research center chooses x_h and the manufacturer chooses x_s simultaneously. The research center and the manufacturer play a simultaneous game in the initial stage. The problem of the research center is to

$$\text{Maximize: } \Pi^0 = \frac{1}{2}R - w_s^{01}x_h$$
$$\{x_h\}$$

The problem of the manufacturer is to

$$\text{Maximize: } \Pi^2 = \frac{1}{2}R - w_u^{21}x_l$$
$$\{x_l\}$$

The ex ante profits, with outsourcing (*OUT*), for the research center boils down to

$$\Pi_R\big|_{OUT} = \lambda\left(1-\frac{\alpha}{2}\right)\left(\frac{2\left(w_u^{21}\right)^x\left(w_s^{01}\right)^{1-x}}{\alpha}\right)^{\frac{\alpha}{\alpha-1}} \tag{6}$$

Therefore, the research center is indifferent between transacting with an independent manufacturer located in country 0 that hires unskilled immigrants from country 1 and outsourcing to an independent manufacturer located in country 2 if $\Pi_R\big|_{IMM} = \Pi_R\big|_{OUT}$ which implies $\frac{w_u^{11}}{w_u^{21}} = A(z)$. $\Pi_R\big|_{IMM} > \Pi_R\big|_{OUT}$ if $\frac{w_u^{11}}{w_u^{21}} < A(z)$ and $\Pi_R\big|_{IMM} < \Pi_R\big|_{OUT}$

if $\frac{w_u^{11}}{w_u^{21}} > A(z)$. Since $\frac{\partial A}{\partial \mu} < 0$ and $\lim_{\mu \to 0} A = \infty$, a decline in μ below a threshold will support immigration raising the skilled-unskilled wage gap in country 0. [QED]

Let us now allow variations in the degree of contractual frictions, á la Acemoglu *et al* (2007). We assume that the low-tech intermediate input is produced with a set of activities, indexed by points on an interval [0, 1], subject to a Cobb-Douglas technology:

$$x_l = e^{\int_0^1 \log x_l(k)\,dk} \tag{7}$$

where $x_l(k)$ represents the manufacturer's input-specific investment in activity *k* that can be used only to produce the input for which it is designed. The activities in the range $[0, \beta]$ are subject to contractual incompleteness i.e. the characteristics of these activities can not be fully specified in advance in an enforceable ex-ante contract.

Proposition 2. *As contractual frictions in the low-tech intermediate decline (rise), for any given level of friction in immigration, the skilled-unskilled wage inequality falls (rises) in the home country.*

Proof: With immigration, the research center's problem is to

$$\text{Maximize:} \quad \Pi^0 = R - w_s^{01} x_h - (1+\mu) w_u^{11} \int_0^\beta x_l(k)\,dk$$

$$\left\{x_h, \{x_l(k)\}_{k=0}^{\beta}\right\}$$

The ex ante profits the research center is:

$$\Pi_R\big|_{IMM} = \lambda(1-\alpha)\left(\frac{\left((1+\mu)\beta w_u^{11}\right)^x \left(w_s^{01}\right)^{1-x}}{\alpha}\right)^{\frac{\alpha}{\alpha-1}} \tag{8}$$

With outsourcing, the problem of the research center is to

Maximize: $\Pi^0 = \frac{1}{2}R - w_s^{01}x_h$

$\{x_h\}$

The problem of the manufacturer is to

Maximize: $\Pi^2 = \frac{1}{2}R - w_u^{21}\int_0^\beta x_l(k)dk$

$\left\{\{x_l(k)\}_{k=0}^{\beta}\right\}$

The ex ante profits for the research center is

$$(9) \qquad \Pi_R\big|_{OUT} = \lambda\left(1-\frac{\alpha}{2}\right)\left(\frac{2\left(\beta w_u^{21}\right)^x\left(w_s^{01}\right)^{1-x}}{\alpha}\right)^{\frac{\alpha}{\alpha-1}}$$

Therefore, $\Pi_R\big|_{IMM} > \Pi_R\big|_{OUT}$ if $\frac{w_u^{11}}{w_u^{21}} < \beta A(z)$ and $\Pi_R\big|_{IMM} < \Pi_R\big|_{OUT}$ if $\frac{w_u^{11}}{w_u^{21}} > \beta A(z)$. A decline in β, for any given level of μ, below a threshold will support outsourcing that will lower the skilled-unskilled wage gap in country 0. [QED]

Finally we allow the degree of contractual frictions to vary in both the intermediates (low-tech and high-tech) i.e. each intermediate is produced with a set of activities subject to a Cobb-Douglas technology:

$$(10) \qquad x_i = e^{\int_0^1 \log x_i(k)dk} \qquad (i = h, l)$$

where $x_i(k)$ represents input-specific investments in activity *k*. The activities in the range $[0, \beta_i]$ are subject to contractual incompleteness.

Proposition 3. *As contractual frictions in the high-tech intermediate decline (rise) relative to the frictions in low-tech intermediate the skilled-unskilled wage inequality rises (declines) in the home country.*

Proof: With immigration, the research center's problem is to

Maximize: $\Pi^0 = R - w_s^{01}\int_0^{\beta_h} x_h(k)dk - (1+\mu)w_u^{11}\int_0^{\beta_l} x_l(k)dk$

$\left\{\left\{x_h(k)\right\}_{k=0}^{\beta_h}, \left\{x_l(k)\right\}_{k=0}^{\beta_l}\right\}$

The ex ante profits the research center is:

$$\Pi_R\big|_{IMM} = \lambda(1-\alpha)\left(\frac{\left((1+\mu)\beta_l w_u^{11}\right)^x\left(\beta_h w_s^{01}\right)^{1-x}}{\alpha}\right)^{\frac{\alpha}{\alpha-1}} \tag{11}$$

With outsourcing, the problem of the research center is to

Maximize: $\Pi^0 = \frac{1}{2}R - w_s^{01}\int_0^{\beta_h} x_h(k)dk$

$\left\{\left\{x_h(k)\right\}_{k=0}^{\beta_h}\right\}$

The problem of the manufacturer is to

Maximize: $\Pi^2 = \frac{1}{2}R - w_u^{21}\int_0^{\beta_l} x_l(k)dk$

$\left\{\left\{x_l(k)\right\}_{k=0}^{\beta_l}\right\}$

The ex ante profits for the research center is

$$\Pi_R\big|_{OUT} = \lambda\left(1-\frac{\alpha}{2}\right)\left(\frac{2\left(\beta_l w_u^{21}\right)^x\left(\beta_h w_s^{01}\right)^{1-x}}{\alpha}\right)^{\frac{\alpha}{\alpha-1}} \tag{12}$$

Therefore, $\Pi_R\big|_{IMM} > \Pi_R\big|_{OUT}$ if $\frac{w_u^{11}}{w_u^{21}} < \frac{\beta_l}{\beta_h} A(z)$ and $\Pi_R\big|_{IMM} < \Pi_R\big|_{OUT}$ if $\frac{w_u^{11}}{w_u^{21}} > \frac{\beta_l}{\beta_h} A(z)$. A decline in β_h, all else equal, below a threshold will support immigration raising the skilled-unskilled wage gap in country 0. [QED]

In sum, for any given level of contractual friction in the production of intermediate goods, the wedge between the wages of the skilled and unskilled workers widens as the frictions in immigration wear out. The skilled-unskilled wage gap, for any given level of friction in immigration, can widen or shrink depending on the contractual frictions in intermediates that affect international outsourcing.

4. Conclusion

We have presented a model of immigration in the presence of the possibility of offshore outsourcing where we demonstrate how interactions between the frictions involved in immigration and outsourcing can affect the skilled-unskilled wage inequality. We have shown that the skilled-unskilled wage inequality, while affected by frictions in immigration, is sensitive to variations in contractual frictions in intermediates that affect international outsourcing. In particular, we predict that a fall in the friction involved in immigration will cause the skilled-unskilled wage gap to widen while the gap would be dampened by a decline in the contractual frictions in the low-tech intermediates. A decline in the contractual frictions in the high-tech intermediate relative to the frictions in low-tech intermediate will increase the wage gap. A natural extension, we are currently working on, of our model is to integrate it with the structure of Antràs and Helpman (2007) allowing cross-country variations in the degrees of contractual frictions. Since this

is an emerging area of research, we hope that future researchers will extend our work within the structure of general equilibrium models.

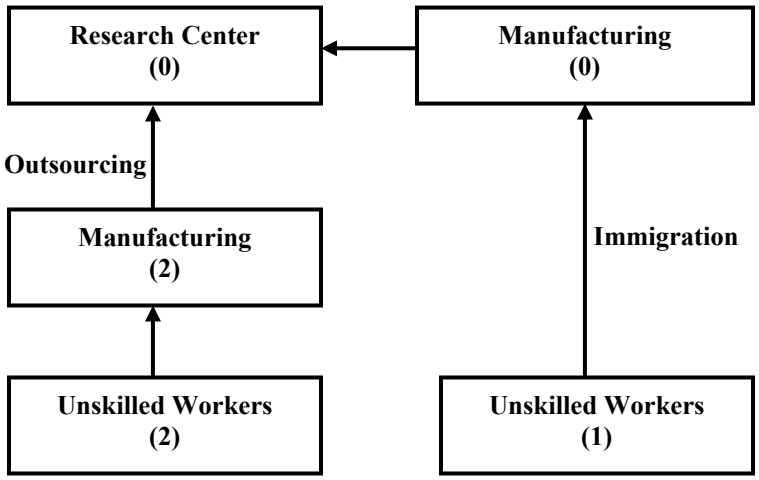

Figure 1. Organizing Production: Immigration from (1) vs. Outsourcing to (2)

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Endnotes

[1] See Jacoby (2006).

[2] At the time of this quote, Gregory Mankiw was the head of President George W. Bush's Council of Economic Advisors.

[3] CNN's Lou Dobbs routinely harangues U.S. companies engaged in offshore outsourcing in his "Exporting America" series. Many IT executives have themselves contributed to this perception. When IBM announced plans to outsource 3,000 jobs overseas this year, one of its executives said, "[Globalization] means shifting a lot of jobs, opening a lot of locations in places we had never dreamt of before, going where there's low-cost labor, low-cost competition, shifting jobs offshore." Nandan Nilekani, the chief executive of the India-based Infosys Technologies, said at this year's World Economic Forum, "Everything you can send down a wire is up for grabs." In January testimony before Congress, Hewlett-Packard chief Carly Fiorina warned that "there is no job that is America's God-given right anymore."

[4] In a thought-provoking article on the labor market effects of U.S. immigration and outsourcing, Jones (2005) pointed out the significance of substitutability/complementarity between immigration and outsourcing.

[5] See Massey et al. (1993).

[6] From an analytical perspective, our model incorporates the possibility of international migration in Antràs' (2005) structure to compare the effects of immigration and outsourcing on the skilled-unskilled wage inequality. Antràs (2005) combined incomplete international outsourcing contracts with a model North-South trade to explain the development of product cycles in which new goods are initially designed and produced in the North, with later production moving to the South. For ease of comparison, we preserve his notations to the fullest extent possible.

[7] This form of demand results from constant elasticity-of-substitution preferences for brands of a differentiated product.

[8] See Antràs (2005) for a more detailed discussion.